

METHODS OF IMPLEMENTING THE CONTENT OF TECHNOLOGICAL EDUCATION IN THE GYMNASIUM


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The article highlights the features of developing methods for implementing the content of technological education in the gymnasium. A method of forming students' basic concepts of technological education, theory and practice of technical creativity of students: "creativity", "creative activity", "stages of creative activity", "project", "design", "design", "sketch". The article defines the content of technological education in the gymnasium, which is important for the formation of project-technological competence, the development of creative technical abilities of students. The most expedient set of stages of the creation of products by students of the gymnasium and the most effective maintenance of their activity at stages of designing and construction of a product have been offered. These stages are defined as two, independent of each other, processes that contain specific, unique creative actions and operations of students. It is emphasized that there is no clear, pronounced "boundary" (transition) between them.

Keywords: technological education, content, methods of content realization, basic concepts, creativity, design, construction.

Formulation of the problem. To conduct research and develop methods of content implementation, we determine the content of technological education of high school students, which will be important for the development of their creative activities, creative technical abilities, the formation of project-technological competence of students. This approach in the content of teaching technology to high school students fully corresponds to the content of the 1st direction of technological education in the new state standard of basic secondary

education “Implementation of the idea into a finished product by the algorithm of project-technological activities.” It emphasizes the importance of the creative activity of students, as the basis of design and technological activities, the implementation of all its stages is the creativity of students, in particular, technical (in the case of creating a technical object). In this context, we note that the basis of all stages of students’ creation of any technical object (product) in the process of design and technological activities of students are: 4 types of technical creativity of specialists and students (design, construction, rationalization, invention), means of technical creativity (methods, techniques, approaches, etc.) and technical technologies. Therefore, the content of the main types of technical creativity of professionals and students, methods, techniques, methods and approaches for their implementation, manufacturing technologies, etc. *is a very important component of the new content of technological education of high school students.* At the same time, the level of complexity of the content should be different for students in grades 5–6 and 7–9, to meet their age characteristics. Subject to successful, thorough mastering by high school students of the peculiarities of all stages of creating a technical product in the process of design and technological activities, their mastery of technologies and basics of theory and practice of technical creativity (in the context of the technical project) the content of education will correspond to the modern technical- technological and engineering-technical direction (unlike the traditional in primary school – only “executive” technical-technological). *School teachers should pay special attention to this*, because for technical progress, this direction of the content of education of high school students, such as future engineers, designers, etc., is of particular importance. The above led to the choice of the content of technological education of high school students to conduct research and develop methods for its implementation in the educational process of high school. Note also that in this article we have focused on developing a methodology for implementing the content of the main stages of product creation – the stages of design and construction. This is due to the fact that it is at these stages that the perfection of the product is ensured, its compliance with the technical task for the development of the technical object (product), and hence the technical progress in general.

However, teachers should be well aware that the presence of only modern content of the technological education will not be able to ensure the formation of students’ project-technological competence, the development of their creative technical abilities at a high level. To meet the requirements of the new state standard, the concept of “New Ukrainian School” requires a modern, effective method of its implementation, which will include methods: forming students’ basic concepts of a certain content of technological education, implementing the content of the main stages of technical facility use of means of technical creativity, which are necessary for the implementation of the content of technological education in the gymnasium, etc.

Thus, there is an urgent need to develop an effective method of implementing the content of technological education of high school students, which would meet the requirements of the new state standard and the concept of “New Ukrainian School”.

Analysis of recent research and publications. In recent decades, the process of implementing the content of technological education in primary school is carried out using a

project approach. The new state standard of basic secondary education, which has already been mentioned above, attaches great importance to the design and technological activities of gymnasium students. Therefore, the project approach should be the basis for the implementation of the content of technological education in the gymnasium, which implies the need to develop appropriate methods.

Since the introduction of the project approach in the content of technological education in Ukraine (2001–2005), scientists have paid considerable attention to the organization of design and technological activities of students, the definition of its stages and their essence and content: O.M. Kobernik, S.M. Yashchuk, A.I. Tereshchuk, T.H. Berbets and others (Kobernik and others, 2001; Tereshchuk and others, 2004; p. 10; Berbets, 2004, p. 13). However, in their works, the 1st stage of the project-technological activity of students is called organizational, which is not logical, first of all, from the point of view of realization of the maintenance of technological education, development of creative abilities of students. In addition, in these works, main attention was paid to the method of organization of design- technological activities, rather than the development of methods for implementing the content of technological education, which corresponds to the stages of product creation by students. Our research, experimental verification of the effectiveness of the created educational materials showed that the most important stage of product creation, which focuses on the main creative activities of students, quite responsible creative actions and operations of students cannot be called organizational. Therefore, A.M. Tarara in methodical and educational manuals “Development of creative abilities of students of grades 5–9 in the course of design and technological activity”, “Technical creativity of students in the course of design and technological activity” and “Design and construction of technical objects” the first stage of product creation is offered to call “Product Design”, which fully complies with the state standard (Tarara, 2008; Tarara, 2014; Tarara, 2019). These manuals also highlight the methodological features of the organization of creative activities of students in grades 5–9 in the process of design and technological activities.

Research of the method of forming the content of labor education in primary school on the basis of project technology (manuals and textbooks for primary school) was conducted by V.I. Tutashynskiy.

In his dissertation research V.P. Melnychuk developed a method of forming technical and design knowledge and skills of rural school students. However, the author considers only established (traditional) methods of forming these knowledge and skills. At the same time, the author also ignores organizational forms of learning, new methods and approaches, the formation of students’ project-technological competence (in the dissertation such tasks were not set). The method of realization of the content of technological education was not considered either.

V.K. Sydorenko, O.M. Kobernik, V.P. Tymenko, M.S. Korets, A.M. Tarara, V.I. Tutashynskiy, T.S. Machacha, V.V. Vdovchenko, L.V. Kilderova, V.M. Slabko, I.V. Zhernokleiev and others considered in their works a wide range of methodological issues of implementing a project-technological approach in the lessons of labor training, methods of organizing project-technological activities of students (Tutashynskiy, 2014, p.772; Kobernik, 2012; Tymenko, 2011, p.251; Machacha, 2011).

The methodological support of students' design and technological activities should include various educational and methodological materials developed by the staff of the Ministry of Education and Science of Ukraine and regional institutes of postgraduate pedagogical education (S.I. Diatlenko, N.I. Borynets, V.M. Hashchak, H.M. Havryliuk and others). Model samples of creative projects, methods of their implementation in the educational process have been developed.

As can be seen from the analysis of literature sources, the scientific developments of scientists relate mainly to the methods of organizing design and technological activities of students. In addition, the above methodological support of the educational process of technology involves the design and technological activities of students (according to existing curricula and textbooks for students of 5–9 grades) after mastering the basics of materials in science, engineering and technology, *which does not meet the new state standard*, underestimates the importance of the project approach as the basis of creative activity of students, the development of their creative abilities. It should also be noted that all the above research *did not involve the development of methods of teaching technology to primary school students, the implementation of the content of technological education on a previously established scientific basis*. Recently, such a scientific basis has been developed by A.M. Tarara (Tarara, 2021, p.226).

Thus, the analysis of the identified problem shows that an urgent problem in pedagogical science is the development of methods for implementing the content of technological education of high school students (new scientific and methodological support), which would meet the requirements of the new state standard, the concept of “New Ukrainian School” and would be based on the established scientific basis.

Formulation of the article's purposes. The purpose of the article is to develop a methodology for implementing the content of technological education in the gymnasium, the formation of students' relevant basic concepts.

Presentation of the main material. In the subsection of the article “Problem statement” the content of technological education has been determined for the development of methods of its implementation in the educational process of the gymnasium. The aim is to develop a methodology that corresponds to the main stages of creation of a technical object – the stages of design and construction. Taking into account the results of the analysis of literature sources, our long experimental testing of materials created in the department, we have developed the most appropriate set of all stages of product creation by students to confirm the importance of developing methods for implementing the content of design and construction stages. The developed set of stages is given below.

Stages of creation of a technical object (product).

1. Product design.

1.1. Problem situation analysis. Problem statement and its substantiation. Selection of the design object. Preparation of a creative technical task for the development of a technical object, taking into account the known information about the object of design.

1.2. Generation of project ideas using methods of technical creativity. Creating an imaginary image of the projected object on their basis and fixing it on paper in the form of diagrams and drawings.

1.3. Resolving technical inconsistencies that arose during the product design process. Forecasting the socio-economic consequences of their technical solutions (task 1.3 is proposed for implementation only by students in grades 7–9).

1.4. Creation of several sketch variants of a product design corresponding to the formulated ideas, offers, etc.

2. Product design.

2.1. Development of the final sketch version of the product design (sketch design) based on the analysis of the results of product design and using the methods of technical creativity.

2.2. Development of a possible assembly drawing for students (grades 7–9) and construction of components of the product design (components, parts), determining the features of their interaction, selection of materials for their implementation, etc.

3. Development of product manufacturing technology.

4. Product manufacturing.

5. Product presentation.

As we can see from the above set of stages of product creation, they are based on 3 types of technical creativity of students: design (this process includes sub-stages 1.1–1.4), product design process (sub-stages 2.1 and 2.2), development of product manufacturing technology (stage 3) and other stages. The product design process is especially difficult for students to understand and implement, as it consists of a large number of creative, diverse actions and operations, which are the basis of logically interconnected 4 sub-stages of product design (see below). Each of these stages of product creation has a certain sequence of its execution, its own features and patterns. For the effective implementation of these stages, students need to know (in addition to the above) methods of creative thinking of students, various types of methods of technical creativity, including methods of design and construction, methods and approaches to solving creative technical problems (contradictions), the essence and content of basic concepts of technical creativity, etc. which is the content of technological education engineering-technical and technical-technological direction of high school students.

Note. Some of the sub-stages, creative actions and operations (more complex) should be offered for performance only by students of 7–9 grades (they are highlighted in parentheses).

First of all, consider the method of forming students' basic concepts of technical creativity, which take place at all stages of creating a technical object – “creativity” and “creative activity”, as well as methods of implementing their content in the educational process of high school.

Executive and creative work. Creativity and creative activity.

Note. In this issue and in the further consideration of the method of content implementation we will give specific examples of methodically correct (in our opinion) educational-methodical activities of teachers in the classroom on a particular issue of stages of creating a technical object, students' use of technical creativity, etc. with an appeal to them in the form of “Friends!”. The content of this activity from beginning to end will be given in quotation marks – so as not to confuse it with other text. However, this does not mean that the teacher should use and follow literally all our instructions – depending on the conditions of the

educational process, the level of preparedness of students, etc. he/she must orient him(herself) in this. In the context of considering the method of implementing the content of a particular issue, we will offer teachers a method of forming in students the basic concepts that correspond to this content. We also emphasize that the developed methodology, first of all, concerns the teaching material for 5th-grade students – in accordance with the content of the new state standard and model curricula.

“Friends! All of you have to ride in cars, taxis, buses, etc. The drivers of these vehicles carry passengers. Drivers of various trucks transport goods. What do the drivers of these vehicles have in common? All of them perform the same, simple work – transportation of people, goods, etc. The same type of “simple” work (though not easy enough) is performed by a worker who builds the wall of the house from individual bricks. However, not all the work of specialists can be called “simple”. Most of you are interested in cars. Have you thought about how such extremely beautiful, technically perfect, modern car brands were created? After all, the first man-made cars were quite primitive! Engineers, designers in the process of long inventive search, careful creative reflection created everything new, with a more perfect design of the car brand.

We considered two types of human labor: the transportation of passengers and goods by drivers and the creation of these vehicles by specialists. Carriage of passengers by drivers is an executive job because it does not involve the use of painstaking mental activity or mental effort. Development (creation) of vehicles, their constant improvement is a creative work. Based on these two types of human work, we can draw very important conclusions for you.

The process of creating any new product that is necessary for the practical activities of a man or his daily life is called creativity.

The process of creating technical objects (various types of cars, technological machines, transport, aircraft, ships, etc.) is called technical creativity or creative technical activity.

What is the significance of this activity? You should be well aware that it ensures the success of our country in the field of aircraft construction, space industry, the creation of modern materials and new technology, and so on. The term “creation of technology” will be understood as further implementation of the design and construction of devices, mechanisms, machines, and more. You will be able to get acquainted in detail with these processes further and practically apply them in the creative activity.

Outstanding engineers and designers are creating more and more new technology. What abilities should they have for such creative activity? What abilities do you need to have to also be a creative person in the field of technology, to be successfully engaged in technical creativity? In the general case, creative abilities include the following human qualities: intelligence, ingenuity, technical thinking, technical creativity, the ability to fantasize and combine, and so on. The ability to apply methods and ways of solving creative tasks, different types of problems is also important for creative activity. In the process of mastering the educational material, during practical classes you will be able to develop the above creative abilities, understand their essence, learn to use methods and techniques of creative activity. Thus (the teacher concludes), the terms “creativity”, “creative activity” should be understood as engineering activities, which involve setting and solving new technical problems, solv-

ing complex problems, creating significantly new in the field of technology, finding ways to solving problem situations “.

We now turn directly to the method of implementing the content of the main stages of product creation in the educational process of the gymnasium. We will begin its consideration with a technique of realization of the maintenance of a stage of designing of a product, having previously noted the following. We have identified the most appropriate set of creative actions and operations of students in the process of performing *the stage of product design*: find and analyze a specific problem situation in your life, be well aware of it; clearly set a problem that corresponds to the given situation and put forward ideas, hypotheses to solve it by creating a specific product; justify the importance and necessity of this product for themselves, loved ones or society as a whole; on the basis of search activity to be able to develop several variants of a design of the future product, to be able to analyze them and to represent on drawing; in the process of developing the design of the product to be able to use creative imagination and fantasy, using such methods as fantasizing and analogies; choose or develop several design options for the product and depict them in the form of a sketch; be able to work with a variety of literature, generate ideas, including original, analyze and synthesize them. *This is the content of the product design stage, the teacher should guide students.*

Methods of implementing the content of the product design stage

Before students directly master the content of the main stages of product creation, the teacher invites students to consider first a set of all 7 stages of product creation, pre-forming in students the basic concept of “stages of creative activity”. This can be done briefly but clearly for students, for example, in this way.

“Friends! You used different types of work when making products in grades 1–4. First, you need to think about what product you want to make. Then you need to think about what product should be in shape, size, color, etc. Then you select the materials and tools for its manufacture and only then make the product itself. This type of work during the creation of the product (technical object) is called the stages of creative activity.

Before the beginning of the 1st lesson on mastering the teaching material by students (note that the teaching process on mastering the basics of product design the teacher starts with 5th-grade students) the teacher writes all the steps on the board or presents them on a poster. This is an important, methodologically correct approach of the teacher – it offers students visual support that will help them immediately understand how important and at the same time difficult learning material they must master while studying in grades 5–9. This approach will interest them, significantly intensifies their cognitive activity to master the content of all stages of product creation, the basics of technical creativity. And after that, the teacher invites students to focus on mastering the content of the 1st stage – the stage of product design, specifying that it has 4 *components*. However, starting the learning process on mastering the basics of product design with 5th-grade students, the teacher first emphasizes that the features of its 3rd component “Resolving technical inconsistencies in the design process” they will get acquainted in grades 7–9. The teacher explains that the concept of “technical contradiction”, its content and essence are difficult to understand for students in grades 5–6.

The main stages of creating a technical object (product).

Product design

“Friends! In the process of learning, inquisitive students have questions such as: “What is the importance in human life of modern, made at a high technical level new technical objects (products)?”, “What professionals create these products?”, “In what way and in what sequence do you create new products?”, “How to learn to create new products on your own?”. Let’s try to find answers to these questions. In your daily life, you have repeatedly used modern products, technical facilities, structures, etc. After all, in order to have a place to live, work, study and spend leisure time, people build various buildings: houses, factories, plants, offices, kindergartens, schools, stadiums. For travel and transportation of goods, people create perfect vehicles: cars, trains, ships, planes. Household appliances help to facilitate the work of people at home: vacuum cleaners, washing machines, food processors. All the achievements of civilization at different times were invented and created by resourceful people. But can you learn to invent and make new products yourself? What requirements does it have to meet to be needed by people? In the process of research for answers to these questions, you should learn, first of all, about people’s needs, learn to find, analyze and evaluate a specific problem situation in life, the solution of which will answer the questions. *Consider an example.* All people love to walk in parks, squares, etc. For relaxation, reading a book you always want to sit, which is especially true for the elderly. There are benches in parks or squares. However, sitting on benches is associated with a number of problems: in summer the sun is very hot right in the face; in winter the benches are covered with snow; in rainy or windy weather it is impossible to use benches at all. How to be? *The considered situation from life is called problematic.*

Properly assessing it, people faced the problem – to create a simple structure in which you could relax in any natural conditions. We formulate a contradiction for this case: people need to rest on a bench (read a book, admire nature, discuss a problem with a colleague, etc.), but under any natural conditions it is impossible to do. People have long since solved this problem (and therefore the contradiction!) – they came up with a simple structure called a gazebo. Let us now consider how we would create such a structure. Its structure and construction can be very diverse – from the simplest (benches have a roof over which rests on 4 supports) to much more complex. For example, you can cover part of the sides with a transparent material (from wind, rain), put a table in the middle (to play chess, write something), etc. Now you can determine the task to be solved in this case (the goal to be achieved) – to create a *gazebo*. For similar reasons, you can come up with another product, such as a house for your dog (especially those students who live in private homes) and many other products. What requirements must the intended product (structure) meet? All the requirements for the product (convenience, reliability, ease of operation, good appearance, etc.) are presented in the form of a task for its manufacture, which is called *technical*. And now let’s think about what should be your creative activity to create a product in general and what it should be called.

Working on the technical task, you begin to think, first of all, about what should be the general shape (appearance) of the product and the relative position of its components, i.e.,

the design of the product (teacher, it is advisable to define the concept of “design”). You offer your ideas. Finally, there is the first idea of a new product, its design. You present it in the form of a picture. But this is not enough – and you create other designs for future products. Then choose the one that best suits its purpose and is most liked by future users. The final design of the product should be performed in the form of its drawing or other image.

Such an image in creative activity is a *sketch* of the product. You will also learn about it in this lesson.

The activity discussed above is painstaking mental work, without which it is impossible to create a new desired product. *Call this process the design of the product.*

Design is a mental (i.e. in thought) creation of the product concept and its reflection in the drawing and sketch. Then what can you call the very idea of the product? The idea (purpose) of the product is called a project, which is also evident from the very definition of the term “design”. *So, the project is a plan of the future product.*

The term “project” has another meaning. The results of further development of the design and the product as a whole are presented in the form of various images, calculations, explanations and other documents, which are commonly called *technical documentation*. It is used to make the product. The set of specified engineering documentation is also called a project. That is, the term “project” has two meanings:

- 1) the plan, the purpose;
- 2) a set of technical documentation required for the manufacture of the product.

The project is the result of creative engineering activities performed by specialists – designers. You will also be able to learn how to design and implement your projects in a training workshop. In this case, the “implementation” should be understood as the process of manufacturing the designed product. As you can see, your creative activity in the process of product design includes all operations from the formation of the product concept to its implementation in the form of a *sketch*.

Since the concept of “sketch” is used when considering the process of product design, we offer the teacher the following method of forming the basic concept of “sketch” in students.

“Friends! The designed (in thought) product you first depicted in the picture. Is such an image of the product enough for further creative work on the creation of the product and its manufacture? After all, you need to imagine not only the shape of the future product as a whole but also know the shape and size of each part, understand how they connect with each other, etc. Such information includes graphic images. A graphic is an image that consists of lines, strokes, dots. *The main graphic images are a sketch and a drawing.* You will get acquainted with the drawing later. The sketch is made by hand on paper in a cell to facilitate this process. The sketches depict the shape of the parts and put the previous dimensions. The image of the product and its components is performed by eye, with respect to the proportionality of the elements. Thus, *a sketch* is an image of a detail that is made by hand, without precise adherence to the scale, with respect to the proportions between its parts. A graphic image in the form of a sketch of the product in its updated version is used for further creative work to create a product. Improving the intermediate version of the sketch is to apply the exact dimensions of the product, clarifying the type of connection of parts, and

so on. An updated sketch is required to perform the next stage – the product design process. You will get acquainted with this process (next after the design) later”.

Next, the teacher should discuss with students the importance of using creative methods in the process of creating products.

“Friends! When designing products, such skills as thinking creatively, fantasizing, using an analogy with nature, exchanging ideas with other students while creating a collective complex product, etc. will be very important for you. Appropriate methods of technical creativity will help you to develop such creative abilities: fantasizing and analogies. After getting acquainted with them, you will use them in the process of designing the product.

Next, the teacher must methodically organize the students’ mastery of these methods. First of all, he/she gives students the task of getting to know them well at home. To do this, he/she reproduces the content of each method or selects the relevant literature. In class, he/she organizes the learning process for students to master these methods.

Stage of product design

Note. In the process of considering the method of implementing the content of the stage of product design, we will limit ourselves to a more generalized statement of features, important issues of teaching students to design their products, development of their design skills without referring to them “Friends”, as teachers will be able to do it independently by analogy with the considered question “Stage of products design”.

At the beginning of the product design phase, the teacher should first inform the students that children often assemble models of cars, planes, ships, and other technical objects using ready-made parts from design kits. In the process of such creative activity, a new product is made from existing, ready-to-use parts, using the instructions for the set. The process of assembling a product in this case is also called design. The teacher draws students’ attention to the fact that from the finished parts of the design set they can design a product without developing a project. That is, the design stage of the product in this case is absent because the instructions already provide a general view of the product and the image in the figure of all its details. By the way, the set may contain several hundred (thousands) of parts! The process of designing from ready-made parts can be regarded (and applied) as the initial stage of the development of students’ design abilities.

The teacher further emphasizes that if there is a product design stage, the process of designing it begins with the development of the final sketch version of the product design (initial design stage) using sketches created by students during the product design stage. In the future, the design process is based on it. First of all, the teacher emphasizes that there are no ready-made details in this case. Each of them must be created at the design stage. It is necessary to determine the shape and size of parts, their location in the product, the nature of the interaction of parts, what material they should be made of, and more. That is, the intended general design of the product must be created from its individual parts, having previously created these parts.

Then the teacher clarifies that at the design stage imaginary parts that are not visible in the picture (they are located behind other parts or are in the joints) must be made in the form of images on paper: it gives the form of parts closed by others, indicates the exact dimen-

sions and other necessary information. The final design of the product is created from the developed parts. Such creative work can be figuratively called the “arrangement” of details at the destination. This is quite painstaking work because you need to correctly calculate the relative position of the components (parts), their interaction, and more. To facilitate such work at the design stage, models of future products are created. The layout of the product is a copy of the future product, which is made in strict compliance with the proportions and dimensions of the product in enlarged or reduced form. The layout is an important illustration, which clearly shows where and how it is most appropriate to place the components of the object and explore their interaction, to determine the final form. “*Considered careful creative work is called product design*” – *the teacher sums up*. Then, based on the above, the teacher must make another conclusion: “*Design is the development of the draft of the product from its components*”. The design involves the execution of the image on paper as components of the product and the final design of the product. Specialists display it on paper in the form of a final technical document, which is called *an assembly drawing*.

At the design stage (*teacher continues his/her educational activity*), in addition to the already considered, the choice of materials, equipment and tools, methods of connecting parts and finishing the product, the technology of manufacturing (processing) of parts is selected. At the same stage, with the help of calculations, experts determine the amount of materials and funds needed to manufacture the product and in general for the project. *The teacher emphasizes* that students will not make complex drawings and calculations.

Above we have considered in detail the content of the design stage of the product. This is necessary, above all, to deepen the teacher’s knowledge – to such an extent, the design stage should be given only to students in grades 7–9. For 5th graders, the content of the design phase should be simplified. In particular, they do not need to make complex sketches and drawings. However, for more technically prepared boys (and in the 5th grade such students may already be!) it is impractical to simplify everything. That is, the teacher should take a differentiated approach to the stage of construction by students of the 5th grade. In conclusion, the teacher emphasizes that the design of the product is a very important stage of product design.

The teacher then informs the students that there are three ways of designing that students should master in the learning process in grades 5–9:

- 1) mental (occurs in human thought);
- 2) graphic (carried out by the designer developing various images of the product and its components);
- 3) subject-manipulation.

Mental design takes place in the process of students developing a product design (project). The essence of object-manipulative construction is that the work of human hands occurs simultaneously with mental construction. This method of construction takes place, for example, when assembling a technical object from a set of prefabricated parts, which we have already discussed. The means of graphic design include different types of images that are needed when creating a product design and in the design process – sketches and drawings.

In the process of considering the design stage (more precisely, at the end), *the teacher informs* students that the creation of the product is based not only on the results of its design

and construction. It is also very important that everyone liked the product, was not only useful, but also beautiful, artistically perfect. In modern design institutions, product designs are developed jointly by design engineers and designers. In the process of joint creative work, technical and artistic perfection of the product is achieved. The product becomes more expressive, comfortable, attractive, takes on original forms, unique decoration and other artistic features that distinguish it from others. The process of artistic development of a new product is called artistic design. *This completes the learning process* for students to master the content of the design stage of the product. However, *the teacher informs the students* that in order to successfully complete the operations of the design phase, they must master the appropriate design techniques (just as they did after the design phase). For students in grades 5–9, the most important and appropriate methods are combining and brainstorming. Just as it was done during the students' mastery of the product design phase, the teacher organizes the students' mastery of these methods and their application in the process of designing products.

Thus, we have considered the method of implementing the content of the main stages of creating a technical object (product) in the educational process of the gymnasium – the stages of design and construction. For students, we defined them as two independent processes. However, the teacher in the process of creating a product should emphasize (with the choice of appropriate conditions) that there is no clear “boundary” (“transition”) between these processes. It is often quite difficult and impractical to determine exactly where the product design process ends and the design process begins. The “boundary” between them is purely conditional: the design “smoothly” logically turns into design.

Conclusions. The article highlights the results of the analysis of literature sources on the research problem. The authors note that a significant number of scientific works are devoted to the consideration of design and technological activities of students in the creation of products. However, most of these works consider only the method of organizing the design and technological activities of primary school students, and not the method of implementing the content of technological education.

The article substantiates the choice of modern content of technical-technological and engineering-technical direction for the study. It is emphasized that for technical progress such direction of the content of education of high school students, as future engineers, designers, etc., acquires special significance.

A method of forming students' basic concepts of technological education, theory and practice of technical creativity of students has been developed: “creativity”, “creative activity”, “stages of creative activity”, “project”, “design”, “sketch”.

The method of realization of the maintenance of the basic stages of creation of technical object (product) in educational process of gymnasium has been developed.

Використані джерела

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МЕТОДИКА РЕАЛІЗАЦІЇ ЗМІСТУ ТЕХНОЛОГІЧНОЇ ОСВІТИ В ГІМНАЗІЇ

У статті висвітлено особливості розроблення методики реалізації змісту технологічної освіти в гімназії. Розроблено методику формування в учнів базових понять технологічної освіти, теорії і практики технічної творчості учнів: «творчість», «творча діяльність», «етапи творчої діяльності», «проект», «проектування», «конструювання», «ескіз». У статті означено зміст технологічної освіти в гімназії, що має важливе значення для формування проєктно-технологічної компетентності, розвитку творчих технічних здібностей учнів. Запропоновано найбільш доцільну сукупність етапів створення виробів учнями гімназії та найбільш ефективний зміст їхньої діяльності на етапах проєктування і конструювання виробу. Ці етапи визначено як два незалежні один від одного процеси зі специфічними, властивими тільки їм творчими діями та операціями учнів. При цьому наголошено, що чіткої, яскраво вираженої «межі» (переходу) між ними не існує.

Ключові слова: технологічна освіта, зміст, методика реалізації змісту, базові поняття, творчість, проєктування, конструювання.